

**2004 WORK PLAN  
FOR THE  
UPPER BLACKFOOT MINING COMPLEX  
LEWIS AND CLARK COUNTY, MONTANA**

**-- DRAFT--**

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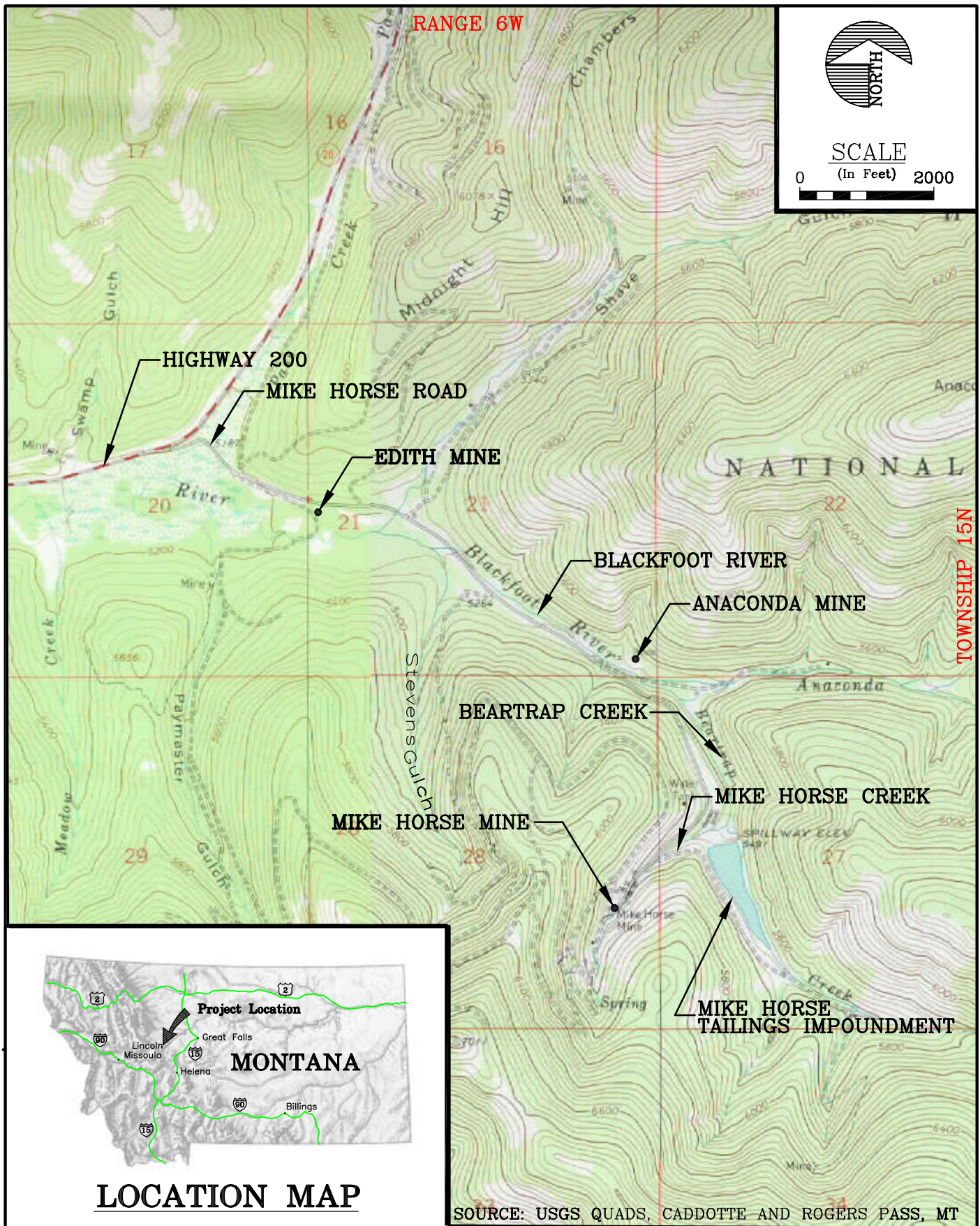
# **2004 WORK PLAN FOR THE UPPER BLACKFOOT MINING COMPLEX, LEWIS AND CLARK COUNTY, MONTANA**

**- DRAFT -**

## **1.0 INTRODUCTION**

The Upper Blackfoot Mining Complex (UBMC) is an area of historic mining activity near the headwaters of the Blackfoot River in Lewis and Clark County, Montana (Figure 1-1). The UBMC, part of the Heddleston Mining District, is comprised of several individual historic mines, all of which have been inactive since at least the 1950s. Asarco, Inc. (Asarco), has been conducting mine reclamation activities at the UBMC since 1993. Reclamation activities have focused on seven individual mines (the Carbonate, Edith, Paymaster, Capitol, Consolation, Anaconda, and Mike Horse mines) all of which are located on patented mining claims owned by Asarco.

Currently, the UBMC mine reclamation program is proceeding under the jurisdiction of both state and federal regulatory programs. In November 1999, Asarco submitted a petition to the Montana Board of Environmental Review for adoption of temporary water quality standards at the UBMC in portions of Mike Horse Creek, Beartrap Creek, and the upper Blackfoot River (Asarco, 1999). One reason for requesting temporary water quality standards was to allow additional historic mining-related reclamation activities to be conducted on National Forest System lands. On May 12, 2000 the Board of Environmental Review approved Asarco's petition and the temporary standards became effective on June 1, 2000. In accordance with Montana law, Asarco prepared an Implementation Plan (Hydrometrics, 1999 and 2000) outlining a conceptual plan and schedule for identifying and addressing remaining sources of water quality impairment in the three petitioned stream segments. Implementation



# **UPPER BLACKFOOT MINING COMPLEX PROJECT LOCATION AND VICINITY MAP**

**FIGURE  
1-1**

Plan activities were initiated in 2000 and continued in 2001 through 2003 (Hydrometrics, 2001a, 2002; Asarco Consulting, Inc., 2004).

Asarco also entered into an Administrative Order on Consent (AOC) in 2003 with the U.S. Forest Service for development of an Engineering Evaluation/Cost Analysis (EE/CA) for portions of the UBMC. Specifically, the AOC applies to those portions of the UBMC located on National Forest System lands in Sections 20, 21, 27 and 28, including the Mike Horse Tailings Impoundment (Figure 1-1). As defined in the AOC, the purpose of the EE/CA is to “determine and evaluate removal action requirements and alternatives designed to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances at the site...”.

This work plan outlines a proposed scope of work for 2004 for the UBMC project. The scope of work fulfills requirements of both the temporary standards Implementation Plan and U.S. Forest Service AOC, and supports mine land reclamation actions proposed for 2004. The 2004 activities are a continuation of the ongoing site characterization and reclamation program and are intended to further document current site conditions, delineate sources of water quality impairment, and assist in reclamation planning.

## **1.1 2004 SCOPE OF WORK**

Year 2004 activities will focus on collection of data and other information necessary for more complete characterization of known and/or suspected sources of water quality impairment in Mike Horse Creek drainage, Beartrap Creek drainage, and the upper Blackfoot River drainage. Specifically, 2004 activities will include:

- Seasonal surface water quality monitoring to provide water quality data for evaluation of long-term water quality trends in response to reclamation activities, and for comparison to the temporary standards;
- Seasonal groundwater monitoring to further delineate sources of metals loading in upper Mike Horse Creek and at the toe of the Mike Horse tailings impoundment;

- Biological monitoring to provide baseline information on benthic macroinvertebrate community composition;
- Soil sampling in the vicinity of the Mike Horse 200 level adit in upper Mike Horse drainage to support scheduled 2004 mine waste removal actions; and
- Continued evaluation of the design and stability of the Mike Horse tailings impoundment.

In addition to the monitoring activities described in this work plan, operation and maintenance (O&M) activities related to the mine drainage water treatment system will continue in 2004. The O&M schedule will include minimum weekly inspections of the Mike Horse pretreatment pond and the Anaconda wetlands treatment system, and monthly sampling of the wetlands discharge. Weekly inspection tasks include monitoring and recording of system pressures and/or flows (at both the pond and wetlands), chemical reagent feed rates, chemical storage volumes, and an overall site inspection for signs of leaks, plugged pipes, or other potential problems.

Section 2 of this work plan describes the surface water monitoring and biological sampling programs. Section 3 describes proposed groundwater sampling activities. Section 4 describes the Mike Horse tailings impoundment evaluation activities. A Quality Assurance Project Plan (QAPP) including field sampling protocol, QA/QC procedures, and other details relating to the 2004 field sampling activities is included in Appendix A. Soil sampling activities associated with the upper Mike Horse mine waste removal action will be included in a removal action construction plan to be submitted by Asarco under separate cover.

## **2.0 SURFACE WATER MONITORING**

Surface water monitoring at the UBMC in 2004 will consist of seasonal surface water and biological sampling. Seasonal surface water quality monitoring will be performed to document current water quality conditions in and downstream of the petitioned segments of Mike Horse Creek, Beartrap Creek, and the upper Blackfoot River. The seasonal surface water monitoring data will be compared to historic water quality data, and future water quality data, to evaluate long-term trends in surface water quality in response to reclamation activities. The surface water monitoring results will also be used for comparison to the temporary water quality standards. The seasonal monitoring program at the UBMC is a continuation of the surface water monitoring conducted by Asarco since 1991.

Biological monitoring will also be performed at two sites in the Blackfoot River to provide baseline information on benthic macroinvertebrate community composition. The resulting baseline data will be used for comparison to future biological data and to previously collected data as appropriate. Both the general surface water monitoring program and the biological monitoring are discussed in this section. Asarco will provide the Montana Department of Environmental Quality (MDEQ) and the U.S. Forest Service with a minimum 10 day advanced notice of all scheduled field activities so that agencies can arrange for oversight of sampling activities if desired.

### **2.1 SEASONAL SURFACE WATER MONITORING**

The objective of the 2004 seasonal surface water monitoring is to document current water quality conditions at the UBMC, and to provide data for evaluation of temporal water quality trends within and downstream of the petitioned drainages in response to completed and future remedial activities. The following sections describe the sampling locations, methods, analytical parameters, and schedule.

#### **2.1.1 Monitoring Locations and Methods**

The seasonal surface water monitoring program will include water quality sampling and flow monitoring at a minimum of 11 locations. The proposed 2004 surface water monitoring

locations are shown on Figure 2-1 and are described in Table 2-1. The monitoring stations were selected to provide adequate spatial coverage in the three stream segments where temporary standards apply. Five proposed sampling sites are located on the Blackfoot River, three on Beartrap Creek, and three sites on Mike Horse Creek (Table 2-1). Two of the Blackfoot River sites are located downstream of the stream segment where temporary standards apply, and are intended to assess surface water quality downstream of the project area. All proposed sampling sites have been sampled previously by Asarco and were included in the 2003 monitoring program.

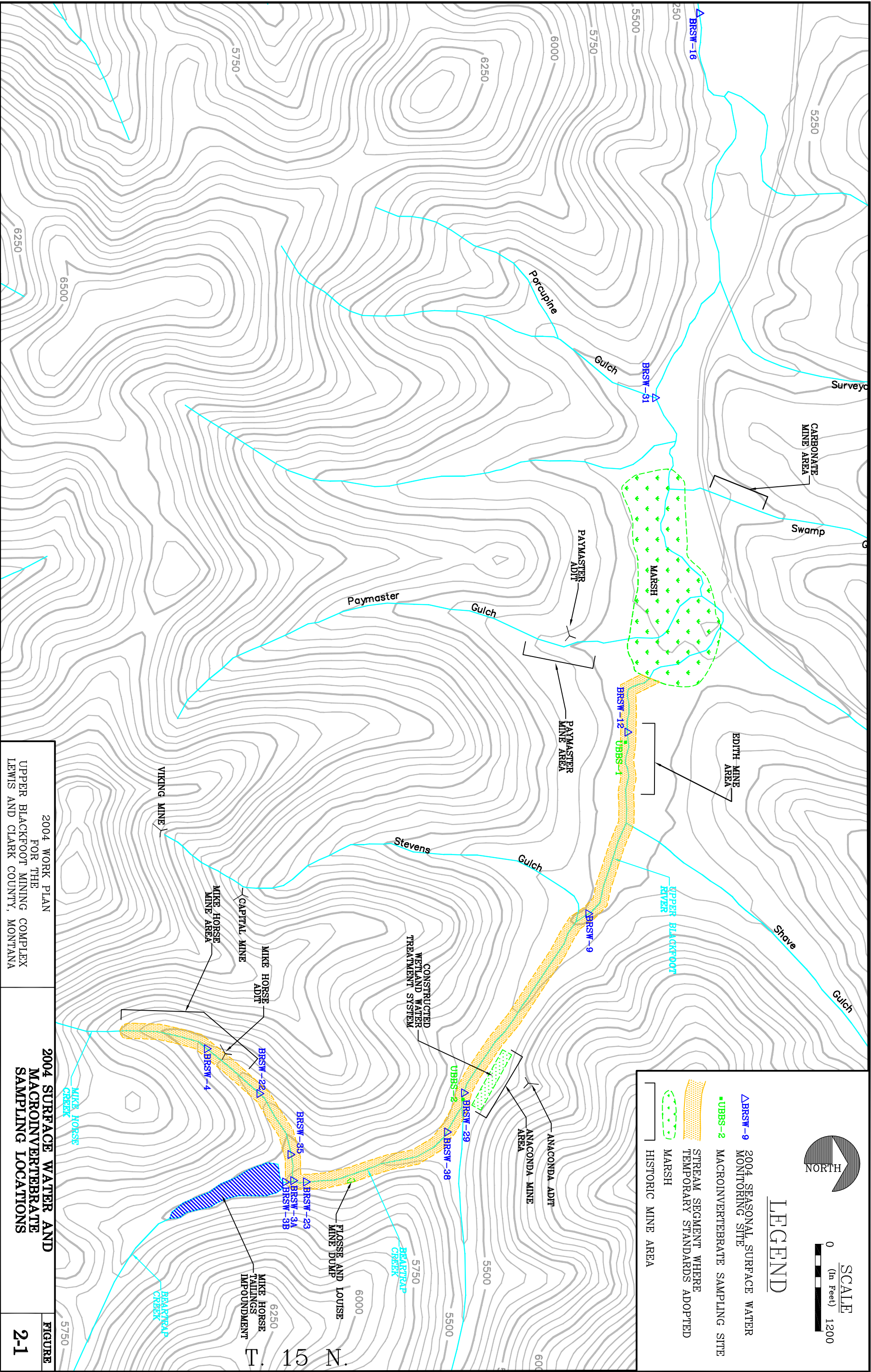
Additional samples may be collected at sites of interest (seeps, springs, tributaries, mainstem sites) based on initial monitoring results and on observations and conditions encountered in the field. Surface water samples will be collected for analysis of total recoverable metals, dissolved metals, and common constituents (major cations/anions and physical parameters) at each site. Sample collection will proceed in a downstream to upstream direction to avoid possible contamination of downstream samples due to upstream sampling activities. Specific protocols for flow measurement and sample collection at surface water sites are presented below.

### **Flow Measurement**

Surface water flow measurements will be collected using one of three methods, depending on the channel geometry and stream or seep discharge rate:

- Marsh-McBirney current meter and wading rod (velocity-area method);
- Portable trapezoidal flume; or
- Volumetric method.

If stream or seepage flow is too small to allow measurement by one of the above methods, or streamflow conditions preclude safe wading, flow will be estimated by the field sampling team.



**TABLE 2-1. UBMCM SEASONAL SURFACE WATER MONITORING LOCATIONS**

<b>Site Code</b>	<b>Description</b>
<i>Upper Blackfoot River Drainage</i>	
BRSW-16	Blackfoot River below Meadow Cr. Bridge, approximately 3,500 feet downstream of Paymaster Cr.
BRSW-31	Blackfoot River at Meadow Creek Road bridge, downstream of first natural marsh
BRSW-12	Blackfoot River upstream of first natural marsh, near downstream end of stream segment where temporary standards apply.
BRSW-9	Blackfoot River at county road crossing approximately 1,400 feet upstream of Shave Creek
BRSW-29	Blackfoot River downstream of confluence of Anaconda/Beartrap Creeks
<i>Beartrap Creek Drainage</i>	
BRSW-38	Beartrap Creek upstream of confluence with Anaconda Creek.
BRSW-23	Beartrap Creek downstream of Mike Horse Creek confluence.
BRSW-3	Seepage stream at toe of tailings dam on Beartrap Creek. Seepage will be sampled at downstream end (BRSW-3A) and at upstream end (BRSW-3B).
<i>Mike Horse Creek Drainage</i>	
BRSW-35	Mike Horse Creek upstream of confluence with Beartrap Creek, adjacent to tailings dam
BRSW-22	Mike Horse Creek downstream of county road crossing, within Lower Mike Horse waste piles
BRSW-4	Upper Mike Horse Creek between 300 Level adit and 200 Level adit

The Marsh-McBirney current meter is used to measure streamflow at larger, wadeable stream sites. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible to minimize potential measurement error introduced by converging or turbulent flow paths.

Streamflow measurements on smaller streams or seeps are obtained using a portable flume such as a 90° v-notch cutthroat flume. This flow measurement method is based on equations developed by Skogerboe et al (1967). To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the upstream ( $H_a$ ) and downstream ( $H_b$ ) sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow.

Collection of volumetric flow measurements consists of directing the flow into a container of known volume (such as a five-gallon bucket or one liter sample bottle), and recording the time required to fill the known volume. Volumetric flow measurements are typically limited to monitoring points with small seepage flows or discrete discharge points (e.g., pipes).

All flow measurement results will be recorded in a dedicated project field notebook and on standard field sampling forms and maintained in the project file.

### **Field Parameters and Water Quality Sampling**

The parameters pH, specific conductance (SC), dissolved oxygen (DO), and water temperature will be measured at each site concurrently with sample collection. Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and on calibration forms. Field parameter measurements are obtained directly in the stream or seep if possible. Where the volume of water is insufficient for in situ measurements, a clean container is filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms. Field meters are checked periodically throughout the day for drift by measuring standard solutions (pH buffers, SC standard solutions), and are recalibrated as necessary.

Water quality samples will be collected from each surface water monitoring site by passing an uncapped sample container across the area of flow, such that the sample is representative of the channel cross-section. If stream velocity or wading conditions preclude this technique,

the sample will be collected from the center of the channel. When wading, samples are collected upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Sample containers will be rinsed three times with sample water prior to sample collection, and will be labeled with a unique sample identification number, the date and time of collection, the type of sample collected (preservation, filtered/unfiltered), and required analyses. Samples will be preserved in the field as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C for transport. The samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. Sample container and preservation requirements are summarized in Table 2-2.

Filtered samples (for dissolved metals analyses) are processed by first collecting a water sample in a clean sample bottle, then pumping through a disposable cartridge filter (0.45 µm nominal pore size) using a peristaltic pump and silicone tubing, into a second sample container prior to preservation. The first 250 to 500 mL of water passed through the filter is used as a filter rinse, and will be discarded prior to filling sample bottles. Silicone tubing used for filtration is typically reused between sample locations, and is thoroughly decontaminated between uses with deionized water. Cartridge filters are one-use only, and are discarded after sample processing.

**TABLE 2-2. SEASONAL SURFACE WATER MONITORING SAMPLE  
CONTAINER AND PRESERVATION REQUIREMENTS**

<b>Sample Matrix</b>	<b>Parameter(s)</b>	<b>Filtration</b>	<b>Container</b>	<b>Preservation</b>
Surface Water	Total Recoverable Metals	No	500 mL polyethylene	HNO <sub>3</sub> to pH <2; cool to 4°C
	Dissolved Metals	Yes (0.45 µm filter)	500 mL polyethylene	HNO <sub>3</sub> to pH <2; cool to 4°C
	Major Cations/Anions and Physical Parameters	No	1000 mL polyethylene	Cool to 4°C

All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook.

### 2.1.2 Seasonal Sampling Schedule

The seasonal monitoring program schedule is designed to provide water quality data during both spring runoff (both rising and falling limbs of the annual stream hydrograph), and low flow periods in the designated drainages. Water samples will be collected from each monitoring station in April, May, June, and October 2004 (Table 2-3). Three monitoring episodes are scheduled for the spring runoff period (April - June), since this period typically shows the highest variability in water quality. One monitoring event is proposed during the baseflow period (October) since previous sampling has shown that water quality does not vary significantly during late summer through fall. The April, May, June and October sampling schedule is intended to meet the sampling objectives outlined in Table 2-3. Actual sampling dates may vary slightly depending on the timing of spring runoff and climatic conditions.

**TABLE 2-3. SEASONAL SURFACE WATER MONITORING SCHEDULE**

<b>Sample Collection Date</b>	<b>Purpose</b>
Late April	Early runoff sample; rising limb of stream hydrograph
Late May	Late spring (runoff) sample; near stream hydrograph peak
Mid to late June	Post-runoff sample; falling limb of stream hydrograph
Mid October	Low flow sample

The schedule of four seasonal surface water sampling events per year was established as a minimum for the first three years (June 2000 through June 2003) that temporary water quality standards are in effect and will be continued in 2004.

The April seasonal monitoring event will be conducted in late April, when snowmelt has typically progressed enough to allow access to most sites. Any sites still under snow will be dug out to obtain access if possible. The June sampling event will occur in mid to late June during the falling limb of the spring runoff hydrograph. The April and June events will provide additional water quality data during the early runoff and late runoff periods, respectively, for which limited water quality data is currently available. The May and October seasonal monitoring events will be a continuation of the annual high and low flow water quality monitoring conducted since 1991, thus providing data for comparison to historic water quality data.

### **2.1.3 Analytical Parameters**

Table 2-4 presents the field and laboratory analytical parameter list for seasonal surface water monitoring samples. This list is similar to that used historically for seasonal monitoring at the UBMC (1991-1999), and identical to the list used for 2000-2003 monitoring. For consistency with previous investigations, field parameters will be collected in accordance with field standard operating procedures (SOPs) previously approved for data collection activities at the UBMC in 2001 and previous years. Trace metal analyses will include aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc. Both total recoverable and dissolved metals analyses will be performed to distinguish between the potential metal phases present. Major cations/anions and physical parameters will include calcium, magnesium, sodium, potassium, sulfate, total alkalinity, total acidity (if pH less than 6.0), TDS (total dissolved solids), TSS (total suspended solids), and pH. Field parameters will include pH, specific conductance, dissolved oxygen, water temperature, and streamflow.

### **2.1.4 Field Quality Control Samples**

Field quality control (QC) samples will be collected and analyzed as part of the program for evaluation of data quality. Required surface water field quality control sample types and sample frequency are summarized in Table 2-5.

**TABLE 2-4. 2004 UBM WATER RESOURCES MONITORING  
ANALYTICAL PARAMETER LIST**

Parameter	Analytical Method <sup>(1)</sup>	Project Required Detection Limit (mg/L)	Holding Time
<i>Field Parameters</i>			
pH	Field SOP	None	field analyzed
Specific conductance	Field SOP	None	field analyzed
Dissolved oxygen	Field SOP	None	field analyzed
Water temperature	Field SOP	None	field analyzed
flow	Field SOP	None	field analyzed
<i>Laboratory Parameters</i>			
<i>Major Cations/Anions and Physical Parameters</i>			
Calcium (Ca)	215.1/200.7	5	6 months
Magnesium (Mg)	242.1/200.7	5	6 months
Sodium (Na)	273.1/200.7	5	6 months
Potassium (K)	258.1/200.7	5	6 months
Sulfate (SO <sub>4</sub> )	375.x	1	28 days
Total alkalinity as CaCO <sub>3</sub>	310.1	5	14 days
Total acidity (if pH<6.0)	305.1	5	14 days
Total dissolved solids	160.1	10	7 days
Total suspended solids	160.2	10	7 days
pH	150.1	None	analyze immediately
<i>Metals (Total Recoverable and/or Dissolved)<sup>(2)</sup></i>			
Aluminum (Al)	202.1/200.7/200.8	0.05	6 months
Arsenic (As)	202.1/200.7/200.8	0.005	6 months
Cadmium (Cd)	213.2/200.7/200.8	0.0001	6 months
Copper (Cu)	220.2/200.7/200.8	0.001	6 months
Iron (Fe)	236.1/200.7	0.01	6 months
Lead (Pb)	243.1/200.7/200.8	0.003	6 months
Manganese (Mn)	239.2/200.7/200.8	0.01	6 months
Zinc (Zn)	289.1/200.7/200.8	0.01	6 months

NOTES: (1) Field Standard Operating Procedures (SOPs) approved for previous work at the UBM will be used as guidance for collection of field water quality parameters. Laboratory analytical methods are from EPA's *Methods for Chemical Analysis of Water and Wastes* (1983). Equivalent methods may be used providing required detection limits are achieved.

(2) Total recoverable and dissolved metals will be analyzed for surface water samples; only dissolved metals will be analyzed for groundwater samples.

**TABLE 2-5. SEASONAL SURFACE WATER MONITORING FIELD QUALITY  
CONTROL SAMPLE FREQUENCY**

<b>Field QC Sample Type</b>	<b>QC Sample Frequency</b>
DI/Rinsate Blanks	1 per monitoring event
Duplicates	1 per monitoring event
Laboratory Splits	2 per year (May and October monitoring events)
Blind Field Standards	2 per year (May and October monitoring events)

Blank samples will be collected to estimate the potential for sample contamination from any materials contacting sample water (filtration equipment, bottles, preservatives etc.) and from random atmospheric contamination. The deionized equipment rinsate sample will be collected by filling sample bottles with reagent-free deionized water in the field, preserving as appropriate, and submitting the sample blind to the laboratory for analysis. The blank sample for dissolved metals analyses will be deionized water passed through the filtering equipment.

Field duplicate and split samples will be collected to estimate field and laboratory precision. Field duplicate samples will be collected by sequentially filling two sets of sample bottles at the same monitoring location, assigning unique sample numbers to the two samples, and submitting both samples to the laboratory for analysis. Field split samples will be collected similarly, except that the two sets of sample bottles will be assigned the same sample number and will be submitted to two different laboratories. The field split sample thus provides an independent check on the performance of the primary laboratory. Field split samples will be collected for the May and October sampling events only.

Blind field standards are samples of known concentration with established control limits, obtained from a third-party vendor (i.e., not prepared by the field team or the analytical laboratory). Standards provide a check on the accuracy of laboratory analyses through a comparison of laboratory results to the established control limits. As with the field split

samples, blind field standards will be submitted during the May and October sampling events only.

All field QC samples will be submitted blind to the laboratory (QC samples will be packaged and shipped in such a manner that the laboratory will not be aware of the nature of the samples). Further discussion of QC samples, including required laboratory QC samples and target control limits for both field and laboratory QC samples, is presented in the project QAPP (Appendix A).

## **2.2 BIOLOGICAL MONITORING**

Macroinvertebrate sampling was initiated by Asarco at the UBMC in September 2000 with establishment of biological monitoring site UBBS-1 on the Blackfoot River. Monitoring site UBBS-2 was established and sampled in October 2001. Macroinvertebrate sampling will continue in 2004 to provide additional baseline information on macroinvertebrate community compositions in the Blackfoot River headwaters. This baseline information will be used for comparison to future biological data to assess temporal trends in aquatic conditions in response to planned reclamation activities.

### **2.2.1 Macroinvertebrate Sampling Locations and Frequency**

Macroinvertebrate sampling will occur at two sites in 2004. Site UBBS-1 is located on the Blackfoot River upstream of the natural marsh near surface water monitoring site BRSW-12. Site UBBS-2 is located on the Blackfoot River a short distance downstream of the Beartrap Creek/Anaconda Creek confluence, near surface water site BRSW-29. Both site locations are shown on Figure 2-1.

The two sampling sites were selected to serve as suitable long-term biological monitoring stations to assess the response of the aquatic ecosystem to future upstream reclamation activities. The sites are located in relatively shallow (less than 2 feet deep), low velocity flow (less than 3 ft/sec) areas with suitable substrate, gradient and cover conditions.

Consistent with the 2000, 2001 and 2003 macroinvertebrate sampling program, one sampling event will be conducted in 2004. The sampling will be performed under baseflow conditions in the late summer or early fall, with the exact schedule depending on the 2004 streamflow hydrograph. The timing of the 2004 sampling event will be selected to match hydrologic conditions representative of the previous biological sampling events (i.e., similar flow rates), so that the resulting information will be suitable for comparison to the existing data.

### **2.2.2 Biological Sampling Methodology**

Macroinvertebrate sampling techniques will follow the Rapid Bioassessment Protocols adopted by the Montana Department of Environmental Quality (MDEQ, 1998) for high gradient streams. Macroinvertebrate samples will be collected using a 0.1 m<sup>2</sup> Hess sampler with a mesh size of 500 µm (or comparable equipment). The precise sampling technique will be customized to target all macroinvertebrates from all habitats present within the riffle for collection. All samples will be labeled and preserved in the field. Information on stream conditions (flow, water quality, clarity, etc.) will be entered in the project notebook and all sites will be photographed. Water temperature, pH, SC, and dissolved oxygen will be recorded and streamflow measured at each site to document stream conditions at the time of sampling.

Macroinvertebrate samples will be submitted to a qualified analytical laboratory for analyses. Sample analyses will include identification to the lowest taxonomic level possible and enumeration by taxon. These data will provide a list of species, relative abundance, number of taxa, dominant taxa, and percent dominant taxa for comparison to future data.

In addition to benthic macroinvertebrate sampling, Asarco will coordinate the 2004 (and future) biological monitoring activities and overall project planning efforts with state and federal resource agencies that may be involved with biological monitoring in the project vicinity. It is generally understood that fish populations currently present in the area are limited. Any fisheries information obtained through the ongoing efforts of the Montana Department of Fish, Wildlife and Parks, the Helena National Forest, or other state or federal

resource agencies will be incorporated into the long-term project planning to maximize benefits to the Blackfoot River fishery resulting from Asarco's ongoing reclamation program.

### 3.0 GROUNDWATER MONITORING

Groundwater monitoring will be conducted at selected monitoring wells in 2004 in conjunction with seasonal surface water monitoring. Results of the groundwater monitoring will provide information on the interrelationship between groundwater and surface water quality in the project area, and on the sources and mechanisms of metals loading to area streams.

#### 3.1 GROUNDWATER MONITORING LOCATIONS AND SCHEDULE

The 2004 groundwater monitoring program will include sampling of eight monitoring wells, including five wells located in upper Mike Horse drainage and three wells located near the base of the Mike Horse tailings dam. All of the wells proposed for sampling were installed in 2001 for the specific purpose of identifying remaining sources of water quality impairment at the UBMC. Groundwater monitoring locations are described in Table 3-1 and shown on Figure 3-1.

Five monitoring wells in the upper Mike Horse Creek area and three wells at the toe of the Mike Horse tailings dam will be sampled in 2004. The upper Mike Horse wells were installed in 2001 to better characterize an area of acidic seeps in terms of the nature, extent and source of the seepage water. Previous surface water sampling has shown this seepage to be a significant source of metals loading to Mike Horse Creek (Hydrometrics, 2001a). Wells UMHMW-1s and -1d are located near the Mike Horse 200 level adit, and were installed as far upgradient of the surface seepage as access permitted (Figure 3-1). UMHMW-1d is completed in bedrock to a total depth of 42.5 feet below ground surface (bgs), while UHMW-1s is completed in unconsolidated colluvium/fill material immediately above the bedrock contact (Table 3-1). Well pair UMHMW-2d and 2s are located in the area of surface seepage. UMHMW-2d is completed in bedrock and UMHMW-2s is completed in the overlying alluvium/fill. Water quality data from these wells will help determine the vertical extent of metals bearing groundwater and variations in groundwater quality between the

**TABLE 3-1. 2004 GROUNDWATER MONITORING SITES FOR THE UPPER  
BLACKFOOT MINING COMPLEX**

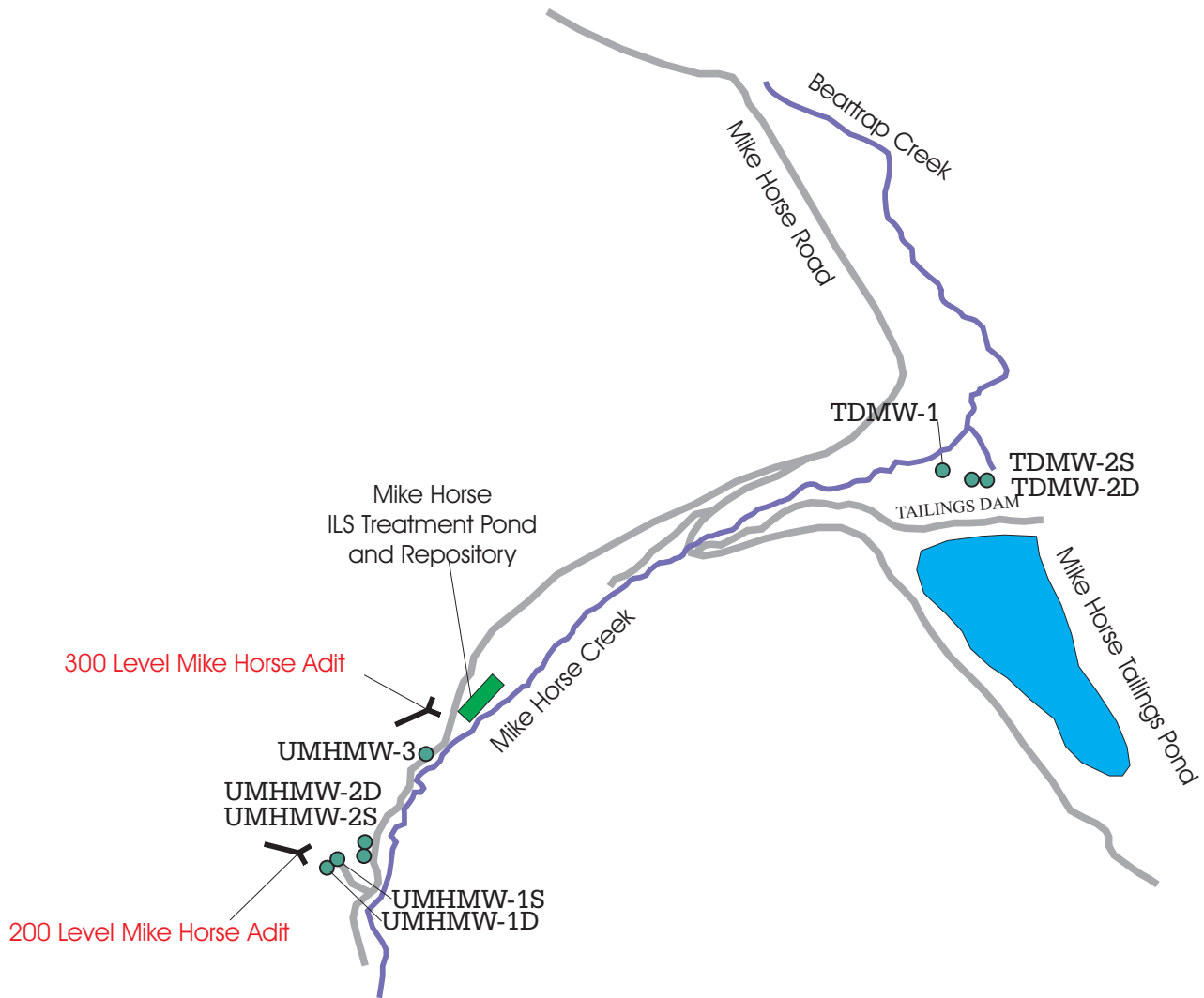
<b>SITE</b>	<b>LOCATION</b>	<b>TOTAL DEPTH</b>	<b>SCREENED INTERVAL</b>	<b>TARGET AQUIFER</b>	<b>OCTOBER 2001 SWL</b>
UMHWMW-1S	Upper Mike Horse Drainage	15	5 to 15	Colluvium/Fill	Dry
UMHWMW-1D	Upper Mike Horse Drainage	42.5	30 to 42.5	Bedrock	28.09
UMHWMW-2S	Upper Mike Horse Drainage	11.5	6.5 to 11.5	Alluvium/Fill	5.34
UMHWMW-2D	Upper Mike Horse Drainage	19.5	14.5 to 19.5	Bedrock	8.20
UMHWMW-3	Upper Mike Horse Drainage	15	10 to 15	Bedrock	9.36
TDMW-1	Base of Mike Horse Tailings Dam	34	12 to 34	Alluvium	11.95
TDMW-2S	Base of Mike Horse Tailings Dam	17	7 to 17	Alluvium/Fill	10.96
TDMW-2D	Base of Mike Horse Tailings Dam	37	22 to 37	Alluvium	10.95

Total Depth and Screened Interval measured as feet below ground surface.

SWL-Static water level; measured in feet from top of PVC casing



APPROXIMATE SCALE  
1 in = 600 ft



### LEGEND

● TDMW-1      Monitoring Well

2004 WORK PLAN FOR THE  
UPPER BLACKFOOT MINING COMPLEX

**2004 UBMC GROUNDWATER  
SAMPLING LOCATIONS**

**FIGURE**

**3-1**

alluvium and bedrock aquifers. Well UMHMW-3 is located north and downhill of the other two well pairs (Figure 3-1). Groundwater quality data from this well will help define the lateral extent of metals-bearing groundwater.

The three wells located at the toe of the tailings dam were installed in 2001 to evaluate groundwater quality immediately downgradient of the dam. Monitoring well TDMW-1 is completed to a total depth of 32 feet in native alluvium (Table 3-1). Sampling results from this well will provide information on general groundwater quality downgradient of the dam, and near the confluence of Mike Horse Creek and Beartrap Creek drainages. Well pair TDMW-2d and TDMW-2s are located at the dam toe near the former channel of Beartrap Creek. TDMW-2d is screened in alluvium immediately above the bedrock contact while TDMW-2s is screened between 7 and 17 feet bgs in a mixture of alluvium/fill material. Sampling results from these three wells, in conjunction with sampling results from surficial seepage at the toe of the dam, will better quantify metals loading to area surface waters and groundwater from the Mike Horse tailings impoundment.

Groundwater samples will be collected in conjunction with the 2004 seasonal surface water sampling events scheduled for May and October (see Table 2-3). This sampling schedule will provide information on groundwater quality for various points on the seasonal groundwater hydrograph. Coordinating the groundwater sampling with the four surface water sampling events will aid in determining the interrelationship between the two hydrologic systems.

### **3.2 GROUNDWATER SAMPLING METHODOLOGY**

Collection of groundwater samples from site monitoring wells will generally consist of three steps:

1. Measurement of static water level;
2. Well purging and monitoring for field parameter stabilization; and
3. Water quality sample collection.

Prior to collection of samples, static water level will be measured at each well using an electric water level probe to determine the depth to groundwater below a specified measuring point (typically the top of the PVC well casing). Water level measurements will be combined with surveyed monitoring well elevations to compute groundwater elevations at each monitoring point. Water level measurements may also be collected during well purging and following groundwater sampling to assess well recovery.

Depending on the depth to groundwater, a submersible pump, peristaltic pump, or plastic bailers will be used to purge and sample monitoring wells and piezometers. Purging will consist of removing three to five well volumes (including well casing and borehole annulus volume) while routinely monitoring field parameters (pH, dissolved oxygen, temperature, specific conductance) at least twice during removal of each well volume. Samples will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes have been removed and successive field parameter measurements agree to within the stability criteria given below;
- At least five well volumes have been removed although field parameter stabilization criteria are not yet met; or
- The well has been bailed or pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed.

Criteria for field parameter stabilization are as follows:

Parameter (Units)	Stability Criteria
pH (standard units)	± 0.1 s.u.
water temperature (°C)	± 0.2 °C
specific conductance (µmhos/cm)	± 5% (SC ≤ 100 µmhos/cm) ± 3% (SC > 100 µmhos/cm)
dissolved oxygen (mg/L)	± 0.3 mg/L

NOTE: Stability criteria obtained from USGS *National Field Manual for the Collection of Water Quality Data: Chapter A4, Collection of Water Samples* (September 1999).

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from the pump or bailer discharge port.

General field parameter measurement and water quality sampling procedures have been presented in Section 2.1.1 above: sample containers will be rinsed three times with sample water prior to sample collection, then preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C for transport. Filtered samples (for dissolved metals analyses) will be processed as described in Section 2.1.1. Any groundwater sampling equipment reused between monitoring locations (e.g., pumps, discharge lines, etc.) will be thoroughly decontaminated between uses.

All groundwater quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, static water level measurements, pumping rates, well purging information, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook.

### **3.3 ANALYTICAL PARAMETERS**

Groundwater samples will be tested for the parameters listed in Table 2-4. Field-measured parameters include pH, specific conductance, temperature and dissolved oxygen. In addition, the static water level will be measured at each well and piezometer prior to sampling. Laboratory parameters include major ions (calcium, magnesium, sodium, potassium), sulfate, total dissolved solids, total suspended solids, alkalinity, acidity (if pH<6.0), and the metals, aluminum, arsenic, cadmium, copper, iron, lead, manganese and zinc. As noted in Table 2-4, metals analyses will be for dissolved metals only. This parameter suite is the same as that used by Asarco for surface water and groundwater sampling at the UBMC for the past several years.

### **3.4 FIELD QUALITY CONTROL SAMPLES**

Field quality control (QC) samples will be collected and analyzed as part of the program for evaluation of data quality. Required groundwater field quality control sample types and

sample frequency are summarized in Table 3-2. For groundwater monitoring, one DI/rinsate blank and one duplicate are proposed for collection during each monitoring event. General QC sample types are described in Section 2.1.4. The equipment rinsate blank for groundwater will consist of deionized water processed through decontaminated sample collection equipment (including bailers, pumps, and filtration equipment as appropriate). The laboratory split and blind field standard samples submitted as part of the surface water monitoring program (Section 2.1.4) will also provide information on analytical accuracy for the groundwater monitoring program.

**TABLE 3-2. SEASONAL GROUNDWATER MONITORING FIELD QUALITY  
CONTROL SAMPLE FREQUENCY**

<b>Field QC Sample Type</b>	<b>QC Sample Frequency</b>
DI/Rinsate Blanks	1 per monitoring event
Duplicates	1 per monitoring event

#### 4.0 MIKE HORSE TAILINGS DAM INVESTIGATIONS

Asarco has been conducting investigations of the Mike Horse tailings dam and impoundment over the past few years. A preliminary assessment was completed in 2001 for the purpose of:

1. Determining if the design, construction, and operation of the dam meets applicable U.S.F.S. and State of Montana Dam Safety Requirements; and
2. Providing a preliminary evaluation of the overall stability and integrity of the embankment structure.

Findings of the preliminary assessment were submitted to the U.S.F.S. and MDEQ in an August 20, 2001 memorandum (Hydrometrics, 2001b). The preliminary evaluation provided hydrologic modeling results including the predicted runoff and reservoir response to the ½ probable maximum precipitation (PMP) event. Modeling results indicated that the tailings dam may be overtopped as a result of the ½ PMP, leading to the recommendation that an emergency overflow spillway be constructed. Follow-up tasks completed in 2003 include:

- Installation of two new piezometers near the dam crest to a greater depth than the four previously installed piezometers;
- Monitoring of piezometer water levels and the tailings pond stage;
- Excavation of exploratory backhoe pits along the toe of the dam to investigate for signs of piping;
- Monitoring of seepage flow rates at the tailings dam toe; and
- Collection of tailings pond sediment samples.

Results of the 2003 activities are discussed in the 2003 UBMC Monitoring report (Asarco Consulting, Inc., 2004).

Field investigations will continue in 2004 at the tailings impoundment to further assess the dam stability. The 2004 activities will include:

- Monitoring of seasonal flow rates and characteristics of seepage at the tailings dam toe; and
- Monitoring of water levels in the six tailings dam piezometers and the corresponding tailings pond stage.

Pending development of the EE/CA and associated discussion with the Forest Service and MDEQ, additional field activities may be undertaken in 2004 relative to the tailings impoundment.

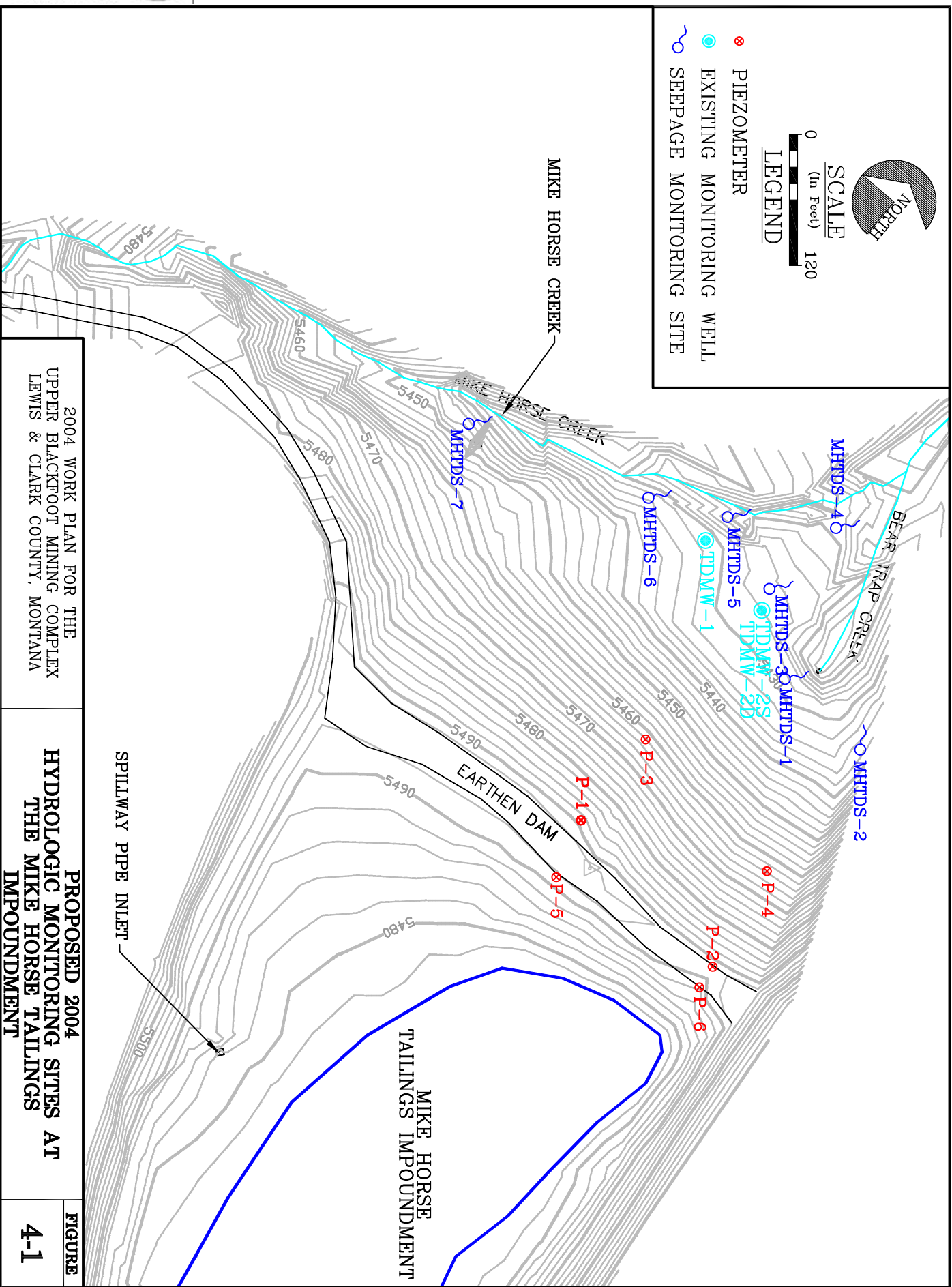
#### **4.1 MONITORING OF TAILINGS DAM SEEPAGE FLOW RATES AND CHARACTERISTICS**

A number of seeps emerge during wet season conditions (spring through mid-summer) at the toe of the Mike Horse Dam. These seeps, or seepage areas, have previously been monitored for flow and/or water quality by Asarco (Hydrometrics, 2002; ACI, 2004) as well as others (MBMG, 1998). This objective of the previous monitoring was to determine metals loading rates from the tailings dam seeps to Beartrap Creek.

The tailings dam seeps will be monitored in 2004 for flow rates and field parameters to assess the correlation between the tailings pond stage and seepage rates. Select seeps will also be monitored for indications of sediment transport, or piping, such as seep water turbidity or total suspended sediment concentrations. Unlike the previous sampling events, the 2004 seep monitoring is intended to provide information on seepage flow through the dam, and not on seep water quality or loading rates.

##### **4.1.1 Monitoring Locations and Methods**

Seeps identified during previous investigations near the base of the tailings dam are described in Table 4-1 and shown in Figure 4-1. The 2004 seepage characterization will include monitoring of these seeps (if present during the 2004 sampling event), and delineation of any new seeps.



**TABLE 4-1. 2004 MIKE HORSE TAILINGS DAM SEEPAGE TARGET  
MONITORING LOCATIONS**

<b>Site Code</b>	<b>Description</b>
MHTDS-1	Orange/white/yellow-stained seep above seepage culvert at base of dam (site BRSW-3)
MHTDS-2	Clear seep above MHTDS-1 on east edge of dam face
MHTDS-3	Orange/white stained sheet flow west of MHTDS-1
MHTDS-4	Clear seepage from grassy area at dam toe near Mike Horse Creek (flows directly into creek)
MHTDS-5	Representative orange/white stained seep along Mike Horse Creek bank west of MHTDS-4
MHTDS-6	Clear seep from beneath rock outcrop along Mike Horse Creek west of MHTDS-5
MHTDS-7	Orange/red stained seep immediately west of pond overflow culvert along Mike Horse Creek

Any new seeps identified will be given a unique site code (consistent with the previously sampled seeps) and located on a detailed base map or aerial photograph. All newly identified seeps will be surveyed for horizontal and vertical control with a precision-grade GPS system, and staked and labeled in the field for future identification.

Seepage flow rates will be measured bi-weekly (once every two weeks) from May through July. Flows will be measured with a portable flume, Marsh McBirney current meter, volumetrically (as described in Section 2.1.1), or estimated. The seeps will also be inspected for sediment plumes where the seeps discharge from the subsurface, or suspended sediment entrained within the flow, both of which could indicate piping.

Field measurements of water pH, SC, temperature and dissolved oxygen will be recorded at each seep bi-weekly for the purpose of assessing the water source (i.e., groundwater or tailings pond water). Relevant observations such as water color, sediment staining, and vegetation patterns will also be recorded on project field forms. Special attention will be paid to potential indications of piping, such as turbid water or the presence of sediment plumes near the seep sources. Initially, water samples will be collected from all seeps, allowed to completely settle, and inspected for sediment accumulation. Any seeps showing potential signs of sediment transport will continue to be sampled for analysis of turbidity and total suspended sediments (TSS).

## **4.2 WATER LEVEL MONITORING AND DAM STABILITY ANALYSIS**

Measurements of the depth to the tailings dam phreatic surface, or water table, will be recorded in the six tailings dam piezometers in 2004. The purpose of the water level monitoring is to allow determination of hydraulic gradients and seepage velocities within the dam, which in part determine the potential for sediment piping to occur. The piezometer data will also be used in conjunction with tailings pond stage measurements to determine the correlation (and cause and effect relationship) between the tailings pond reservoir elevation and the phreatic surface within the dam.

Piezometer water levels will be measured weekly from April through July when water levels are expected to show the greatest fluctuations, and every other week from August through October. Water level measurements will be recorded with an electric sounding tape to the nearest one-hundredth of a foot.

The tailings pond elevation, or stage, will also be recorded in conjunction with the piezometer readings. Incorporation of the pond stage data will allow for a more complete assessment of the seepage gradient and seepage velocities within the embankment, and the correlation between the pond stage and phreatic surface. The pond stage will be monitored on the same schedule as the piezometers.

At the end of each month, Asarco will review the water level data collected from the six piezometers and the tailings pond, along with the seepage flow, field parameter and sediment transport data. This data will be evaluated to determine if seepage is being safely controlled by the existing embankment, and to verify that seepage is not impacting the strength and stability of the dam. Results of the monthly updates will be shared with the U.S.F.S. and MDEQ so that additional data collection and investigation needs, such as completion of cone penetrometer tests, can be assessed and incorporated into the 2004 program as warranted.

## 5.0 PROJECT SCHEDULE AND REPORTING

Table 5-1 provides a schedule for 2004 field activities at the UBMC. Some activities, such as the April and May surface water sampling events, are weather dependent and the schedules may need to be modified slightly based on snowpack and streamflow conditions. Asarco will provide MDEQ and the U.S.F.S. with a minimum 10 days notice of all scheduled sampling activities. Asarco will also provide the Forest Service 21 days notice of any land disturbing activities on National Forest System lands as required by the AOC. Asarco will also provide advanced notice to the agencies of any additional field activities they may undertake beyond those included in this work plan. Additional activities could include supplemental surface water or groundwater sampling events, field planning and/or data collection to support reclamation activities scheduled for 2004, or other project-related activities.

**TABLE 5-1. PRELIMINARY 2004 FIELD ACTIVITIES SCHEDULE FOR THE UPPER BLACKFOOT MINING COMPLEX**

<b>FIELD ACTIVITY</b>	<b>SCHEDULE</b>
<b>GENERAL MONITORING ACTIVITIES</b>	
Surface Water Sampling	April, May, June and October 2004
Macroinvertebrate Sampling	Fall 2004
Groundwater Sampling	May and October 2004
<b>TAILINGS IMPOUNDMENT ASSESSMENT ACTIVITIES</b>	
Tailings Dam Seepage Flow Monitoring	Biweekly from May through July
Piezometer Water Level Measurements	Weekly April through July; Biweekly August-October
Tailings Pond Stage Monitoring	Weekly April through July; Biweekly August-October

Following the completion of Year 2004 field activities at the UBMC, and receipt and review of analytical data, a 2004 Data Summary Report will be prepared. The Data Summary Report will include, at a minimum, all field and laboratory analytical data generated during implementation of this work plan (in tabular form), maps of sampling locations, loading calculations for surface water resources, and measured groundwater depths and elevations. In addition, a discussion of any data quality problems encountered will be provided in the Data Summary Report.

In accordance with the UBMC Implementation Plan, the schedule for submittal of the 2004 Data Summary Report will be as follows:

- Draft 2004 Data Summary Report: submit by January 15, 2005; and
- Final 2004 Data Summary Report: submit by 20 business days after receipt of all agency comments.

## 6.0 REFERENCES

- ASARCO, Inc., 1999. Petition for Adoption of Temporary Water Quality Standards for a Portion of Mike Horse Creek, a Portion of Beartrap Creek, and a Portion of the Upper Blackfoot River. Prepared for the Board of Environmental Review. October 1999.
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- Hydrometrics, Inc., 2000. Revised Implementation Plan in Support of Adoption of Temporary Water Quality Standards, Upper Blackfoot Mining Complex. Prepared for ASARCO Incorporated. August 2000.
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- USGS, 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, 1977 (with subsequent revisions through 1983).
- USGS, 1999. National Field Manual for the Collection of Water-Quality Data. Techniques of Water Resources Investigations, Book 9, September 1999.

**APPENDIX A**

**UPPER BLACKFOOT MINING COMPLEX  
2004 WORK PLAN  
QUALITY ASSURANCE PROJECT PLAN**

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**APPENDIX A**

**UPPER BLACKFOOT MINING COMPLEX**

**2004 WORK PLAN**

**QUALITY ASSURANCE PROJECT PLAN**

**-DRAFT-**

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March 2004

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**UPPER BLACKFOOT MINING COMPLEX  
2004 WORK PLAN  
QUALITY ASSURANCE PROJECT PLAN**

**- DRAFT-**

**1.0 INTRODUCTION**

This Quality Assurance Project Plan (QAPP), prepared as Appendix A to the Upper Blackfoot Mining Complex (UBMC) 2004 Work Plan, is intended to provide guidance and quality assurance requirements for implementation of 2004 environmental field investigations at the UBMC near Lincoln, Montana.

This QAPP has been prepared in accordance with applicable U.S. Environmental Protection Agency (EPA) guidance (EPA 1998a, 1998b). In general, the QAPP outlines field and laboratory methodologies that will be required for completion of specific project activities, with the goal of generating a data set of sufficient quality to support future regulatory and/or remedial decisions concerning the UBMC. The content and level of detail in the QAPP have been structured to be appropriate to the scope of work as outlined in the Work Plan. The document is organized according to the following major headings, with Sections 2.0 through 5.0 corresponding to the four standardized groups of elements required in QAPPs (EPA, 1998b):

- **Section 1.0 – Introduction;**
- **Section 2.0 -- Project Management;**
- **Section 3.0 -- Measurement/Data Acquisition;**
- **Section 4.0 -- Assessment/Oversight;**
- **Section 5.0 -- Data Validation and Usability; and**
- **Section 6.0 – References.**

Each section discusses the QAPP elements applicable to 2004 environmental field investigations and activities at the UBMC, with reference to the scope of work and project objectives outlined in the Work Plan. This QAPP is intended to address collection of environmental data proposed in the Work Plan, including primarily water sampling and analysis.

## **2.0 PROJECT MANAGEMENT**

The project management section of the QAPP is intended to ensure that the project goal and approach has been defined and is agreed upon by project participants, through a discussion of project history and current objectives, roles and responsibilities of participants, and presentation of project Data Quality Objectives (DQOs) (EPA, 1998b).

### **2.1 PROJECT ORGANIZATION**

Overall project management for activities at the UBMC will be coordinated among several entities, including Asarco and the Montana Department of Environmental Quality (MDEQ). Activities conducted on National Forest System Lands will also be coordinated with the United States Forest Service (USFS). Designated project managers from Asarco, MDEQ, and USFS will be the primary data users and decision-makers for the UBMC site.

The State of Montana has adopted temporary water quality standards in portions of three drainages at the UBMC (Mike Horse Creek, Beartrap Creek, and the Upper Blackfoot River). The 2004 Work Plan is part of the overall UBMC Implementation Plan intended to identify and mitigate, to the extent achievable, remaining mining-related impacts to water quality in these drainages.

Asarco has also entered into an Administrative Order on Consent (AOC) with the U.S. Forest Service for development of an Engineering Evaluation/Cost Analysis (EE/CA) for portions of the UBMC. The AOC became effective on February 10, 2003. As defined in the AOC, the purpose of the EE/CA is to “determine and evaluate removal action requirements and alternatives designed to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances at the site...”. The 2004 Work Plan contains elements intended to comply with portions of the AOC.

Asarco or a contractor selected by Asarco will implement the UBMC 2004 Work Plan/QAPP, and will be responsible for providing staff to fill the following positions:

- Project Management;
- Health and Safety Officer;
- QA/QC Officer;
- Field Team Leader; and
- Field crews and/or subcontractors for environmental sampling and any additional field activities.

## **2.2 PROBLEM DEFINITION AND BACKGROUND**

The Upper Blackfoot Mining Complex (UBMC) is an area of historic mining activity near the headwaters of the Blackfoot River in Lewis and Clark County, Montana. The UBMC, part of the Heddleston Mining District, is comprised of several individual historic mines, all of which have been inactive since at least the 1950s. Asarco, Inc. (Asarco), has been involved in a voluntary reclamation program at the UBMC since 1993. Reclamation activities have focused on seven individual mines (the Carbonate, Edith, Paymaster, Capitol, Consolation, Anaconda, and Mike Horse mines) all of which are located on patented mining claims owned by Asarco.

In November 1999, Asarco submitted a petition to the Montana Board of Environmental Review for adoption of temporary water quality standards at the UBMC in portions of Mike Horse Creek, Beartrap Creek, and the upper Blackfoot River. On May 12, 2000 the Board of Environmental Review approved Asarco's petition and the temporary standards became effective on June 1, 2000. Included with Asarco's petition for temporary standards were a Support Document and Implementation Plan. The Implementation Plan (Hydrometrics, 2000) outlines a conceptual plan and schedule for identifying and addressing remaining sources of water quality impairment in the three petitioned stream segments. Additionally, as described above, in early 2003 Asarco and the USFS also entered into an AOC, portions of which address work to be completed at the Mike Horse Tailings Impoundment located on Beartrap Creek. This QAPP and associated Work Plan

have been prepared in accordance with the UBMC Implementation Plan and the AOC, and describe activities to be conducted in 2004 at the UBMC.

### **2.3 SCOPE OF WORK**

Consistent with the Implementation Plan and the AOC, year 2004 activities will focus on collection of data and other information necessary for more complete characterization of known and/or suspected sources of water quality impairment in Mike Horse Creek, Beartrap Creek, and the upper Blackfoot River, and for evaluating remedial alternatives for these sources. Specifically, 2004 activities will include:

- Surface water and groundwater quality monitoring to further delineate remaining sources of water quality impairment in the petitioned stream segments, to provide water quality data for evaluation of long-term water quality trends in response to reclamation activities, and for comparison to the temporary standards;
- Continued assessment of seepage from the Mike Horse Tailings Impoundment; and
- Biological monitoring to provide baseline information on benthic macroinvertebrate community composition.

Activities related to evaluation of the structural stability of the Mike Horse Dam (Section 4.2 of the Work Plan) are not addressed in this QAPP. The QAPP focuses primarily on the collection and analysis of environmental samples (water, sediment, and biological samples).

### **2.4 PROJECT DESCRIPTION**

Year 2004 field activities at the UBMC proposed under the associated Work Plan and addressed in the QAPP include the following:

#### Surface Water Sampling

- Seasonal surface water sampling at pre-established monitoring stations in the upper Blackfoot River watershed, and analysis for an extended suite of parameters including

field parameters (pH, specific conductance, dissolved oxygen, and water temperature), major constituents (calcium, magnesium, sodium, potassium, sulfate, alkalinity, acidity, total dissolved solids, and total suspended solids), and total recoverable and dissolved metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc). Streamflow will also be measured at each sampling location. Seasonal monitoring will occur in April, May, June and October and will be used to assess temporal trends in stream water quality.

#### Groundwater Sampling

- Groundwater sampling in upper Mike Horse Creek drainage and downgradient of the Mike Horse Tailings Impoundment. Groundwater samples will be analyzed for field parameters (pH, specific conductance, dissolved oxygen and water temperature), major constituents (calcium, magnesium, sodium, potassium, sulfate, total dissolved solids), and dissolved metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc). Depths to groundwater will also be measured in each well.

#### Tailings Dam Seepage Monitoring

- Seepage monitoring will occur in 2004; unlike monitoring in previous years, however, the 2004 monitoring will be targeted to provide information on seepage flow rates through the dam relative to pond stage, rather than on seepage water quality or loading rates. Seepage flow rates will be measured every two weeks from May through July 2004 with a portable flume, Marsh McBirney current meter, or volumetrically. Water quality parameters (pH, SC, temperature, dissolved oxygen) will be measured during these inspections, and observations on water color, sediment staining, and potential indications of piping (turbidity, sediment plumes) will be recorded (see Work Plan Section 4.1).

#### Biological Monitoring

- Benthic macroinvertebrate sampling will be performed to provide baseline information. Macroinvertebrate sampling will occur at two locations in the upper

Blackfoot River in late summer or fall (August or September) 2004. Sampling and analytical methodologies will follow the Rapid Bioassessment protocols adopted by MDEQ (MDEQ, 1998).

The sampling design (sampling objectives, locations, frequency, and analytical parameters) and sampling methods for the UBMC 2004 monitoring program are discussed in Section 3, with specific details presented in appropriate sections of the Work Plan.

## **2.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

Quality objectives and criteria for measurement data have been developed for the UBMC through systematic planning in general accordance with the Data Quality Objectives (DQO) process (EPA, 1994). The purpose of the DQO process is to ensure that data of the appropriate type, quality, and quantity are collected to support decisions to be made at the site.

The issues to be addressed at the UBMC under this QAPP and the associated Work Plan are presented above in Section 2.3. In summary, environmental data collection activities will be focused on the following two primary objectives:

1. Delineation of remaining sources of water quality impairment within portions of Mike Horse Creek, Beartrap Creek, and the Upper Blackfoot River, in accordance with the Implementation Plan; and
2. Evaluation of the Mike Horse tailings dam, including dam stability, phreatic surface (water table), and dam seepage quantity and source, in accordance with the AOC SOW.

Decisions to be made at the UBMC can be qualitatively summarized as follows:

1. For each potential source of water quality impairment, does the data indicate that the potential source is or is not a significant source of water quality impairment in the drainage?
2. If the data indicate that the potential source is a significant source of water quality impairment in the drainage, what are the feasible alternatives for mitigating or removing the source?

Those potential sources that are confirmed during site characterization activities as significant sources of water quality impairment within the study areas will be addressed during the subsequent remedial phase of the UBMC Implementation Plan and/or during development of the EE/CA under the AOC. In order to ensure that the data collected are suitable in type, quantity, and quality to provide decision makers with the necessary information to evaluate alternatives, the following analytical data quality objectives and measurement criteria have been incorporated into the UBMC 2004 Work Plan/QAPP:

- The sampling design, field methods and standard operating procedures, and analytical requirements for water and mine waste samples have been specifically identified in the appropriate sections of the Work Plan and QAPP to ensure that representative samples are collected and analyzed;
- Field and laboratory quality control samples and target control limits have been stipulated in Section 3.6 of the QAPP, to provide estimates of data precision, accuracy, and completeness; and
- Provisions for required field and analytical documentation, project oversight, and data review procedures are also presented in Sections 3.0, 4.0, and 5.0 of the QAPP.

Therefore, adherence to the procedures and requirements set forth in this Work Plan and QAPP will generate a defensible data set, minimizing the likelihood of potential decision

errors at the UBMC for both false positive errors (i.e., deciding that a potential source is not a significant source of water quality impairment, when in fact it is) and false negative errors (i.e., deciding that a potential source is a significant source of water quality impairment, when in fact it is not).

### **3.0 MEASUREMENT/DATA ACQUISITION**

The measurement/data acquisition section of the QAPP ensures that appropriate methods for sampling and analysis, quality control sampling, and data handling are employed through specifying methodologies for the collection, handling, and analysis of samples, as well as management of generated data (EPA, 1998b).

#### **3.1 SAMPLING DESIGN**

The sampling design for each type of monitoring (surface water, groundwater, seeps, and sediments) and each area to be characterized, including numbers and types of samples, sample locations and matrices, measurement parameters, and rationale for the overall design, is presented in Sections 2.0, 3.0, and 4.0 of the Work Plan.

The general approach for the 2004 environmental monitoring at the UBMC divides sampling tasks into the following components:

1. Seasonal surface water monitoring and biological monitoring (Section 2);
2. Seasonal groundwater monitoring (Section 3); and
3. Monitoring of water levels within and seepage from the Mike Horse Dam (Section 4.0).

Based on this scope of work for 2004, field activities will involve sampling of surface water, groundwater, and seepage water. Sampling methods for each of these sample types are presented in Section 3.2 of this QAPP.

#### **3.2 FIELD METHODS**

The general sampling methodology for surface water, groundwater, seeps, and sediments as well as general procedures to be followed for field investigations, are discussed below. Benthic macroinvertebrate sampling will be conducted as described in MDEQ Standard Operating Procedures (MDEQ, 1998). Specific guidance on sample collection and

documentation methods are typically found in Standard Operating Procedures (SOPs) developed and maintained by entities responsible for sample collection or their subcontractors. In order to maintain data comparability, 2004 data collection activities at the UBMC will comply with the procedures outlined in previously approved UBMC Work Plans and QAPPs (e.g., Hydrometrics, 2001). Alternative but equivalent procedures may be used (subject to approval by regulatory agencies) provided sampling and documentation methods conform to generally accepted professional practices.

### **3.2.1 Surface Water and Seepage Sampling**

#### **3.2.1.1 Flow Measurement**

Surface water flow measurements will be collected using one of three methods, depending on the channel geometry and stream or seep discharge rate:

- Marsh-McBirney current meter and wading rod (velocity-area method);
- portable trapezoidal flume; or
- volumetric method.

If stream or seepage flow is too small to allow measurement by one of the above methods, flow will be estimated by the field sampling team.

The Marsh-McBirney current meter is used to measure streamflow at larger, wadeable stream sites. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths.

Streamflow measurements on smaller streams or seeps are obtained using a portable flume such as a 90° v-notch cutthroat flume. This flow measurement method is based on equations developed by Skogerboe et al (1967). To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the upstream ( $H_a$ ) and downstream ( $H_b$ ) sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow based on the water depth.

Collection of volumetric flow measurements consists of directing the flow into a container of known volume (such as a five-gallon bucket or one liter sample bottle), and recording the time required to fill the known volume. Volumetric flow measurements are typically limited to monitoring points with small seepage flows or discrete discharge points (e.g., pipes).

#### **3.2.1.2 Field Parameters and Water Quality Sampling**

Field parameters measured at water quality monitoring sites may include one or more of the following:

- pH;
- Specific conductance (SC);
- Dissolved oxygen (DO); and
- Water temperature;

Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and on calibration forms. Field parameter measurements will be obtained directly in the stream or seep if possible. Where the volume of water is insufficient for in situ measurements, a clean container is filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms. Field meters are checked periodically throughout the day for

drift by measuring standard solutions (pH buffers, SC solutions), and are recalibrated as necessary.

Water quality samples will be collected from each surface water monitoring site by passing an uncapped sample container across the area of flow. When wading, samples are collected near the centroid of flow upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Sample containers will be rinsed three times with sample water prior to sample collection. At seep sites, sample collection methods may vary according to the flow rate, topography, and soil type. In all cases, efforts will be made to collect water samples from seeps with minimal disturbance of the ground surface, to avoid entrainment of particulates into the sample. Usually, a separate sample collection container (e.g., clean plastic bottle with the end cut off) is necessary to collect aliquots of seep water, which are then transferred to sample bottles for preservation and laboratory submittal.

Samples will be preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and are stored on ice in coolers at approximately 4°C for transport. The samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory.

Filtered samples (for dissolved metals analyses) are processed by first collecting a water sample in a clean sample bottle, then pumping through a disposable cartridge filter (0.45 µm nominal pore size) using a peristaltic pump and clean silicone tubing, into a second sample container prior to preservation. Approximately the first 250 to 500 mL of water passed through the filter is used as a filter rinse, and will be discarded prior to filling sample bottles. Silicone tubing used for filtration is typically reused between sample locations, and is thoroughly decontaminated between uses with distilled or deionized water. Cartridge filters are one-use only, and are discarded after sample processing.

All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook (see Section 3.3 of this QAPP).

### **3.2.2 Groundwater Sampling**

Collection of groundwater samples from site monitoring wells will generally consist of three steps:

1. Measurement of static water level;
2. Well purging and monitoring for field parameter stabilization; and
3. Water quality sample collection.

Prior to collection of samples, static water level measurements will be collected at each well using an electric water level probe to determine the depth to groundwater below a specified measuring point. The measuring point is typically the top of the PVC well casing. Water level measurements will be combined with survey elevations for monitoring wells to compute groundwater elevations at each monitoring point. Water level measurements may also be collected during well purging and following groundwater sampling to assess well recovery.

Depending on the depth to groundwater, submersible pumps or plastic bailers will be used to purge and sample monitoring wells. Purging will consist of removing three to five well volumes (including well casing and borehole annulus volume) while routinely monitoring field parameters (pH, dissolved oxygen, temperature, specific conductance) at least twice during removal of each well volume. Samples will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes have been removed and successive field parameter measurements agree to within the stability criteria given below;

- At least five well volumes have been removed although field parameter stabilization criteria are not yet met; or
- The well has been bailed or pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed.

Criteria for field parameter stabilization are as follows:

Parameter (Units)	Stability Criteria
pH (standard units)	$\pm 0.1$ s.u.
water temperature ( $^{\circ}\text{C}$ )	$\pm 0.2$ $^{\circ}\text{C}$
specific conductance ( $\mu\text{mhos/cm}$ )	$\pm 5\%$ ( $\text{SC} \leq 100$ $\mu\text{mhos/cm}$ ) $\pm 3\%$ ( $\text{SC} > 100$ $\mu\text{mhos/cm}$ )
dissolved oxygen (mg/L)	$\pm 0.3$ mg/L

NOTE: Stability criteria obtained from USGS *National Field Manual for the Collection of Water Quality Data: Chapter A4, Collection of Water Samples* (September 1999).

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from the pump or bailer discharge port. General field parameter measurement and water quality sampling procedures have been presented in Section 3.2.1.2 above: sample containers will be rinsed three times with sample water prior to sample collection, then preserved as appropriate for the intended analysis (e.g., nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C for transport. Filtered samples (for dissolved metals analyses) will be processed as described in Section 3.2.1.2. Any groundwater sampling equipment reused between monitoring locations (e.g., pumps, discharge lines, etc.) will be thoroughly decontaminated between uses.

All groundwater quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, static water level measurements, pumping rates, well purging information, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook (see Section 3.3 of this QAPP).

### **3.3 SAMPLE DOCUMENTATION**

Field notebooks will be used to record pertinent sampling information. Notebook entries will include, at a minimum, the following information:

- Project name;
- Date and time;
- Sample location;
- Sample number;
- Sample depth (if applicable);
- Media type;
- Field meter calibration information;
- Sampling personnel present;
- Analyses requested;
- Sample preservation;
- Field observations (soil descriptions and field parameter measurements);
- Weather observations; and
- Other relevant project-specific site or sample information.

Entries will be made in permanent ink, with corrections crossed out with a single line, dated and initialed. Field books will be signed and dated at the bottom of each page by personnel making entries on that page.

Individual samples (including QC samples) will be assigned unique sample numbers according to the following sample numbering scheme:

AAAA-YYMM-XXX

where AAAA is a four-character code denoting the project, YYMM is a four-digit code denoting the year (i.e., 04 for 2004) and month (i.e., 05 for May) of collection, and XXX is a three-digit code that is incremented sequentially for each successive sample (i.e., if the first sample collected is 100, then subsequent samples are numbered 101, 102, 103, etc.).

Additional information to be included on the sample container label will include the date and time of collection, sample preservation information, and requested analytical parameters for the sample.

### **3.4 SAMPLE HANDLING, SHIPPING, AND CUSTODY**

Sample containers and preservation methods for the requested analytical parameters for water samples are listed in Table 2-2 of the Work Plan. Samples will be shipped from the field to the laboratory as soon as practical following sample collection to ensure that holding times are not exceeded.

All sample shipments from the field to the laboratory will conform to Department of Transportation (DOT) requirements for environmental samples. Samples will be shipped in coolers (on ice as appropriate for preservation requirements) strapped in two places with at least two wraps of shipping tape. Coolers will be sealed with custody seals bearing the date and the initials of the shipper. Chain-of-custody procedures will be followed throughout the project by utilizing standard chain-of-custody forms to transfer samples from the field to the laboratory. Each cooler of shipped samples will be accompanied by a cover letter, analytical parameter list, and chain-of-custody documentation for recording the transfer of samples from the possession of field personnel to the possession of the laboratory.

### 3.5 ANALYTICAL LABORATORIES AND METHODS

The primary analytical laboratory for the analysis of water samples collected under this Work Plan/QAPP will be the Asarco Technical Services Center (TSC) Laboratory in Salt Lake City, Utah. The TSC laboratory is certified as an environmental laboratory by the State of Utah and has performed the majority of water quality analyses for the UBMC project. EPA has approved the use of the TSC laboratory on a project-specific basis for a variety of CERCLA projects. Laboratory performance is certified regularly by performance audits conducted by the State of Utah and EPA inspectors, and by the use of EPA protocols. Split samples collected as part of field QC procedures will be submitted to Energy Laboratories in Helena, Montana as an independent check on the primary laboratory's performance. Field water quality parameters will be analyzed by qualified sampling personnel.

The laboratory analytical methods to be used for laboratory analysis of surface water and groundwater collected as part of the 2004 monitoring at the UBMC are listed in Table 2-4 of the Work Plan. These tables also list detection limit goals where relevant. A copy of the applicable table from the Work Plan will be included with each shipment of samples sent to the laboratory. Requested turnaround times for samples submitted to the laboratory (time from receipt of samples at the laboratory to delivery of sample results) will be three weeks.

In the event that analytical problems arise (e.g., matrix interferences or other problems), the laboratory will be responsible for notifying the project manager and QA/QC Officer. The resolution of analytical problems will be determined cooperatively by the project managers in consultation with the analytical laboratory.

### 3.6 QUALITY CONTROL SAMPLES AND CONTROL LIMITS

#### 3.6.1 Field QC

Field quality control (QC) samples will be collected as outlined in the Work Plan, including the following:

##### Surface Water Samples

- Duplicates -- 1 per 20 samples, with a minimum of 1 per monitoring event
- Deionized Water Blanks -- 1 per 20 samples, with a minimum of 1 per monitoring event
- Splits -- 2 per year (May and October seasonal monitoring events)
- Blind Field Standards -- 2 per year during the May and October seasonal monitoring events for metals only (standards will not be submitted for major ions or physical parameters)

##### Groundwater Samples

- Duplicates -- 1 per monitoring event
- Deionized Water Blanks -- 1 per monitoring event
- Equipment Rinsate Blanks -- 1 per monitoring event (collected in conjunction with the deionized water blank)

Target control limits for field blanks (both deionized water and equipment rinsate blanks) are no contaminants present above laboratory detection limits. Duplicate and split samples will be collected and results reviewed to assess the precision (reproducibility) of the data. Target duplicate and split sample control limits for inorganic constituents will be as follows (EPA, 2002):

Water Sample Duplicates (Surface Water and Groundwater): Control limit of  $\pm 20\%$  relative percent difference (RPD) for original and duplicate samples with concentrations greater than 5 times the laboratory detection limit (DL); or control limit of  $\pm$  DL if the original or duplicate concentration is less than 5 times the DL.

Relative percent difference is calculated as follows:

$$RPD = \frac{|S - D|}{\frac{(S+D)}{2}} \times 100$$

where RPD = relative percent difference (%)  
 S = original sample result; and  
 D = duplicate sample result.

Target control limits for blind field standards will be based on manufacturer-specified acceptable ranges.

### 3.6.2 Laboratory QC

Laboratory quality assurance and quality control will be maintained through adherence to the laboratory's internal quality assurance protocol during analysis. Lab QC sample frequency guidelines are specified in quality assurance (QA) plans for each laboratory.

Laboratory analysis for both water and solid matrix samples will include (at a minimum) the following types of QC samples:

- Laboratory preparation blanks;
- Matrix spike duplicates;
- Laboratory duplicates; and
- Laboratory control standards.

Target control limits for laboratory preparation blanks are no contaminants present above laboratory detection limits. Target laboratory duplicate sample control limits for inorganic constituents will be the same as those described in Section 3.6.1 for field duplicates.

Target control limits for matrix (pre-digestion) spike duplicates will be recovery in the range of 75 to 125%. Target control limits for laboratory control standards (LCSs) will be recovery in the range of 80 to 120%.

### **3.7 INSTRUMENT MAINTENANCE AND CALIBRATION**

Routine maintenance and calibration of field instruments (SC meter, dissolved oxygen meter, pH meter, etc.) will be accomplished through following manufacturer's recommendations and accepted field practice as well as applicable SOPs. Field instruments will be checked for proper performance prior to the initiation of field work. Backup instruments or provisions to obtain backup instruments at short notice should be in place prior to the initiation of field work to prevent loss of information due to instrument malfunction.

Calibration of laboratory instruments will be guided by the selected laboratory's internal quality assurance QA plan. Instrument calibration information will be retained by the laboratory and may be examined as necessary during the data review process.

Maintenance of laboratory instruments will be the responsibility of laboratory personnel, and will be conducted in such a manner as to minimize instrument downtime and interruption of analytical work. Trained staff will be responsible for routine maintenance; if major repairs become necessary, authorized technicians will be responsible for repairing instruments. The laboratory will archive maintenance records for all analytical instruments and will provide such information upon request.

### **3.8 DATA MANAGEMENT AND DOCUMENTATION**

Field data (including copies of field notebooks) will be reviewed for completeness and archived in the project file following completion of the field sampling event. Sample collection information will be checked to ensure that appropriate field parameter data have been collected for all sampling locations and that all surface water, groundwater, mine waste, and sediment samples have been collected as specified in the SAP and assigned appropriate sample numbers. In addition, borehole logs and monitoring well

completion information will be transferred to well-logging software for storage and reproduction in electronic format.

The laboratory will provide analytical data for samples in both hard copy and electronic format for transfer to a project-specific database. Data will be reviewed by the laboratory prior to submission to check for transcription errors, and to ensure that all required documentation is included in the submittal package. Documentation for water and solid matrix analytical results will include, at a minimum:

- Chains-of-custody;
- Cover sheet indicating analysis;
- Tabulated analytical results;
- Tabulated reporting limits; and
- QC sample results.

The project database will be maintained in a format amenable to queries and reporting of data in common electronic or hard copy format (i.e., the database will be capable of generating spreadsheet tables, summary data reports, etc. as requested by project personnel).

## **4.0 ASSESSMENT/OVERSIGHT**

The assessment/oversight section of the QAPP covers activities intended to assess the effectiveness of project implementation, including QA and QC requirements.

### **4.1 ASSESSMENT AND RESPONSE ACTIONS**

Regulatory personnel (MDEQ, USFS, or their designated representatives) may provide oversight during implementation of the UBMC 2004 Work Plan. Agency approval of the project Work Plan/QAPP (following an initial review and comment period) will serve as the first step in ensuring the project is implemented in a manner consistent with the overall monitoring objectives. During the field sampling and analysis phase of the project, oversight personnel may conduct audits or assessments of field crews, equipment, record-keeping procedures, laboratory personnel or procedures, or other project team members at their discretion. Oversight personnel may also require the analysis of performance evaluation (PE) samples, and may request splits of any samples collected during the field efforts to verify the reliability of analytical data generated by the laboratory.

Nonconformance with established quality assurance and/or quality control procedures for the project may result in corrective actions in the field or laboratory. The scope of any corrective actions will depend on the particular violation of QA/QC protocols and the potential effects on the end use of the data. Examples of corrective actions are resampling of critical sites or reanalysis of particular parameters. Any corrective actions will be fully documented by field or laboratory personnel, and documentation will be retained in the project file.

### **4.2 PROJECT STATUS REPORTS**

Environmental monitoring at the UBMC will be an ongoing for the next several years, and additional Work Plans and QAPPs will be developed in future years as delineation/characterization and mitigation of loading sources proceeds throughout the

affected drainages. Development of the EE/CA may also require additional Work Plans and QAPPs. As analytical data collected under the guidance of approved Work Plan/QAPP documents is received and reviewed, data summary reports, letter reports, or technical memorandums will be prepared to advise project personnel of results, including QC results. Summary reports will be prepared on an annual basis, or more frequently if required by the AOC.

## 5.0 DATA VERIFICATION AND USABILITY

The data verification and usability section of the QAPP addresses QA activities that occur after sample collection and analysis, and are intended to evaluate data quality relative to project objectives and specified QC criteria.

### 5.1 DATA REVIEW

A review of field and analytical data will be conducted following receipt of the laboratory data package. All water and sediment quality data collected as part of the Work Plan will be validated. The data review will focus on the following QA/QC parameters:

- Completeness of sampling and analysis (correct number and types of samples collected, analyzed for the correct parameters);
- Completeness of field and laboratory documentation (information in field notebooks and on laboratory reports is complete and correct relative to the requirements of the Work Plan/QAPP);
- Holding times;
- Field QC sample results; and
- Laboratory QC sample results.

In addition, laboratory-measured total dissolved solids (TDS) values for water samples will be compared to calculated TDS values (determined from major ion data), and a cation/anion balance performed on each sample. These two calculations will be performed as a check of data integrity.

Data review procedures and application of data qualifiers will follow the general guidance given in *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2002). Data qualifiers will be assigned to data which does not meet target quality control criteria (Section 3.6). A summary of the data qualifier codes is shown in Table A 5-1.

**TABLE A 5-1. DATA VALIDATION CODES AND DEFINITIONS**

<b>CODE</b>	<b>DEFINITION</b>
<b>J -</b>	The associated numerical value is an estimated quantity because quality control criteria were not met. Subscripts for the "J" qualifier: 2- Deviation from required calibration procedures, calibration range exceeded, or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates possible low bias. 4- Other quality control outside control limits.
<b>UJ -</b>	The "U" indicates that the material was analyzed for, but was not detected. The "J" indicates that the associated value is an estimate. Subscripts for the "UJ" qualifier are applied as follows: 1- Blank contamination. Indicates possible high bias and/or false positive 2- Deviation from required calibration procedures, calibration range exceeded, or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates possible low bias. 4 - Other quality control outside control limits.
<b>R -</b>	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

## 5.2 DATA VALIDATION

Summary data validation reports for environmental monitoring at the UPMC will be prepared following review of the data received from the laboratory. Typically, separate validation reports will be prepared covering the results of each separate field monitoring event. The validation report will summarize the QA/QC information from the field event and laboratory analysis (including QC sample results), audit information, corrective actions taken (if any), and the overall results of sampling and analytical activities with respect to Work Plan/QAPP compliance. The primary focus of the data validation report will be an estimate of the effects any deviations from approved procedures may have on the project objectives or data uses. All validation reports prepared for the 2004 field activities will be included as appendices to the 2004 Data Summary Report.

## 6.0 REFERENCES

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